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NOTES ON POLYEMBRYONY

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Polyembryony has been reported as occurring in a large number of species. Braun * in 1860 reported polyembryony as known in twenty-one species, in thirteen genera, and in twelve families. Since that time it has been reported in a number of other species. The causes of this phenomenon are not thoroughly understood and are not always the same. Coulter and Chamberlain † give six different methods by which two or more embryos may be produced in a single seed and three forms of pseudo-polyembryony as follows:

True Polyembryony

A. Embryos derived from cells outside the sac, hence sporophytic tissue (vegetative multiplication or budding).

1. Embryos derived from cells of the nucellus.
2. Embryos derived from cells of the integument.

B. Embryos derived from cells within the sac (parthenogenesis and vegetative apogamy); although not in the same morphological category, embryos from the suspensor are also included in the list (vegetative multiplication or budding).

1. Normal occurrence of two eggs.
2. Embryos from synergids.
3. Splitting of embryos derived from egg.
4. Embryos from antipodal cells.
5. Embryos from endosperm cells.
6. Embryos from the suspensor.

* Braun, A. Ueber Polyembryonie und Keimung von Caelebogyne, ein Nachtrag zu der Abhandlung über Parthenogenesis bei Pflanzen. Abhandl. Kongl. Akad Wiss. Berlin 1859: 109–263. 1860.

† Coulter and Chamberlain. Morphology of Angiosperms. 1903.

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PSEUDO-POLYEMBRYONY

1. Ovules grown together.
2. Division of nucellus.
3. Development of several embryo-sacs in the same nucellus.

Probably the oldest record we have is that of Leeuwenhoek, who found polyembryony in orange seeds in 1719. It is very conspicuous in this genus and has been frequently mentioned in the literature. Although the number of seedlings from a single seed is usually only two or three, it may exceed that number and as many as thirteen seedlings from a single seed have been reported. Strasburger* has made a careful study of polyembryony in a number of species and has found that in the orange (*Citrus Aurantium*) all the embryos except those that developed from the fecundated eggs were produced by cells of the nucellus and to such he gave the name "adventive" embryos. That is to say, these adventive embryos were from the sporophytic tissue of the mother plant, were produced by vegetative multiplication or budding, and therefore derived their character from a single parent. This fact presented a very complicated problem in plant breeding, since in hybridization only those embryos which were produced by the fecundated eggs could possess characters derived from double parentage. This was proved by Webber and Swingle (†, ‡), who collected data for their work on a very large number of *Citrus* seedlings. They called attention also to the facts that the problem was doubly complicated because the hybrids frequently resemble the female parent and because the parents are frequently so similar in appearance that it is impossible to tell whether the seedlings are from hybrids or adventive embryos. However, they also state that the hybrid seedling is almost invariably more vigorous than the seedlings from adventive embryos, a fact which undoubtedly facilitates the work of the plant-breeder to some extent.

* Strasburger, E. Ueber Polyembryonie. Jenaisch. Zeitsch. Naturwiss. **12**: 647–670. 1878.

† Webber, H. J. Complications in Citrus Hybridizations caused by Polyembryony. Science II. **11**: 308. 23 F 1900.

‡ Webber, H. J., & Swingle, W. T. Yearbook of the Department of Agriculture, 1904: 226, 227.

The writer has recently made some observations upon the seedlings of *Mangifera indica* and *Eugenia Jambos*, both of which

FIGURE 1. Germinating seeds of the mango (*Mangifera indica*). One of the seeds is producing eight seedlings.

are tropical trees. In the germination of the seeds both of these species are strikingly similar to the orange. The mango (*M. in-*

dica) also was studied by Strasburger * who reported that it also produced adventive embryos. The writer's observations confirm this view. The seed splits first at the large end and then gradually down the edges. From this opening the seedlings grow, usually more than one and frequently as many as eight. In most cases one seedling is considerably in advance of the others. An examination of the seed about the time of germination shows that the nucellus is broken up into irregular pieces of variable

FIGURE 2. Eight seedlings of the mango (*Mangifera indica*) from the single seed, showing the blocks of nucellus, each producing a seedling.

sizes and that each piece produces a seedling. The writer observed this same tendency for the nucellus to break into pieces in the *Citrus* fruits also but does not know that each of these pieces produces a seedling. The surfaces of these pieces are smooth and apparently along well-defined cleavage planes. The writer is unable to say whether the strongest embryo is from the fertilized egg or not.

* Loc. cit.

Polyembryony was also very common in the rose-apple (*Eugenia Jambos*) but usually the number of seedlings did not exceed three from a single seed. Examination of the mature seeds showed that they also were separated into pieces as in the case of the orange and the mango. However, there were usually two or three, rarely more large pieces and a number of very small pieces. The seedlings were produced from the large pieces. Apparently this is another case of adventive seedlings, the same as found in the orange and the mango.

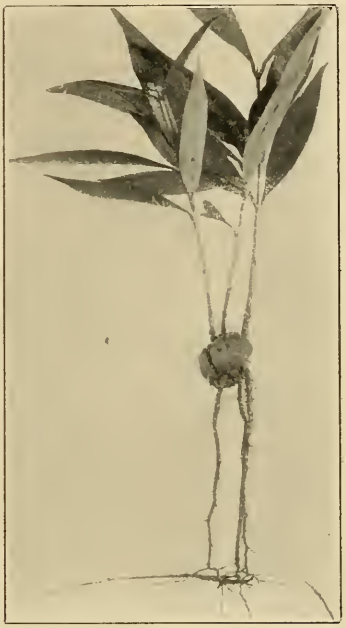

FIGURE 3. Three seedlings of *Eugenia Jambos* from a single seed.

The writer made an attempt to study the embryology of these species but the material was unsatisfactory and he did not have another opportunity to collect material before leaving Cuba.

The mango is recognized as a very important fruit in the tropics and also as one which presents great commercial possibilities. But before it can be of very great value it must be the subject of careful study and experimental work by the plant-breeder and the horticulturist, and then this tendency to polyembryony will present a much more complicated problem than in the case of the orange, since on account of the character of the foliage it will be much more difficult to determine which of the embryos are true hybrids.

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